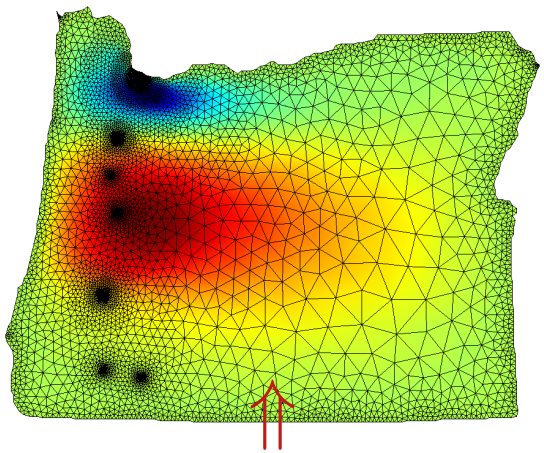
MTH 654/9 (Fall 2023)
FINITE ELEMENT METHODS (FEM)

FEM is a mathematically elegant framework for approximation of solutions to (partial) differential equations based on variational calculus in Hilbert spaces. Its many variants and "dialects" are widely popular in various scientific and engineering applications since the FE mesh and approximating spaces can be tailored to a particular domain and model challenges. The class will introduce the mathematical, algorithmic, and application features of FEM and develop the mathematical and implementation background as needed.
Audience: Graduate students of mathematics and other disciplines with solid skills in (partial) differential equations, linear algebra, and with experience with numerical methods will benefit most from the class. Strong motivation can substitute (some of) the above.

Instructor:
Małgorzata Peszyńska
Department of Mathematics
MWF 09:00-09:50



Group class project from F13

FEM is to computational mathematics & science like advanced calculus to mathematics. Yes, you can live without it, but why would you want to?

Content: In MTH 654/9 we will cover the introductory material on theory, algorithms, and implementation of FEM for second order elliptic and parabolic PDEs including the heat equation, flow problems, and elasticity. We will discuss low and higher order approximations, and coupled and nonlinear problems, in Galerkin and non-Galerkin setting.

Assignments: theoretical exercises will range from basic to advanced, some tailored to the students' background and interest. For computational exercises MATLAB templates will be provided, but experienced students can use selected C++/Python libraries available in public domain. In addition to individual work, the students will be encouraged to participate in group projects.